This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 - 4i)(-6 - 8i)$$

The solution is $-92 - 56i$, which is option D.

A. $a \in [-38, -25]$ and $b \in [-104, -102]$

$-28 - 104i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-38, -25]$ and $b \in [104, 108]$

$-28 + 104i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-92, -87]$ and $b \in [52, 57]$

$-92 + 56i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-92, -87]$ and $b \in [-56, -54]$

* $-92 - 56i$, which is the correct option.

E. $a \in [-63, -58]$ and $b \in [28, 35]$

$-60 + 32i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 8 \div 13 * 16 - (15 * 14)$$

The solution is -207.846, which is option C.

A. $[-202.04, -193.04]$

-198.038, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-182.85, -176.85]$

-179.846, which corresponds to not distributing a negative correctly.

C. $[-213.85, -203.85]$

* -207.846, which is the correct option.

D. $[219.96, 223.96]$

221.962, which corresponds to not distributing addition and subtraction correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-567}{9}}i + \sqrt{55}i$$

The solution is Nonreal Complex, which is option C.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Nonreal Complex

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{119}}{20} + \sqrt{-6}i$$

The solution is Irrational, which is option C.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Irrational

* This is the correct option!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 - 22i}{7 - 4i}$$

The solution is $6.20 + 0.40i$, which is option A.

A. $a \in [6.04, 6.3]$ and $b \in [-0.5, 1]$

* $6.20 + 0.40i$, which is the correct option.

B. $a \in [6.04, 6.3]$ and $b \in [25.5, 28]$

$6.20 + 26.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [402.98, 403.23]$ and $b \in [-0.5, 1]$

$403.00 + 0.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [3.36, 3.52]$ and $b \in [-6, -4.5]$

$3.49 - 5.14i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [6.28, 6.6]$ and $b \in [5, 6]$

$6.43 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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6. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 4^2 + 16 \div 18 * 7 \div 17$$

The solution is -6.634, which is option D.

A. $[25.34, 26.01]$

25.366, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-7.31, -6.88]$

-6.993, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[24.16, 25.14]$

25.007, which corresponds to two Order of Operations errors.

D. $[-6.66, -6.5]$

* -6.634, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(6 - 3i)(7 - 10i)$$

The solution is $12 - 81i$, which is option E.

A. $a \in [36, 44]$ and $b \in [28, 35]$

$42 + 30i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [9, 14]$ and $b \in [80, 82]$

$12 + 81i$, which corresponds to adding a minus sign in both terms.

C. $a \in [66, 75]$ and $b \in [-40, -38]$

$72 - 39i$, which corresponds to adding a minus sign in the first term.

D. $a \in [66, 75]$ and $b \in [38, 47]$

$72 + 39i$, which corresponds to adding a minus sign in the second term.

E. $a \in [9, 14]$ and $b \in [-81, -77]$

* $12 - 81i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-63 + 33i}{-6 + 2i}$$

The solution is $11.10 - 1.80i$, which is option C.

A. $a \in [7.5, 8.5]$ and $b \in [-9, -7]$

$7.80 - 8.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [10, 11]$ and $b \in [15.5, 17]$

$10.50 + 16.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [11, 12]$ and $b \in [-2.5, -0.5]$

* $11.10 - 1.80i$, which is the correct option.

D. $a \in [443, 445]$ and $b \in [-2.5, -0.5]$

$444.00 - 1.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [11, 12]$ and $b \in [-73.5, -71.5]$

$11.10 - 72.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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9. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{102400}{256}}$$

The solution is Integer, which is option B.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Integer

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers.

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -320.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{14}{0}}$$

The solution is Not a Real number, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

* This is the correct option!

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{14}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
